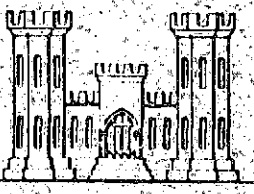
U. S. ARMY

CORPS OF ENGINEERS

HURRICANE SURVEY

COLONIAL BEACH

WESTMORELAND COUNTY, VIRGINIA



U.S ARMY ENGINEER DISTRICT WASHINGTON

CORPS OF ENGINEERS

FIRST AND DOUGLAS STREETS, N.W.

WASHINGTON 25, D.C.

FEBRUARY 1961

SYLLABUS

The purpose of this investigation is to determine the advisability of hurricane protection works for the Town of Colonial Beach, Westmoreland County, Virginia. It was found that the town is subject to severe damage from tides, waves and winds, but that the construction of protective works including floodwalls, levees and gated barrier is not economically feasible. Accordingly, the authorization of a hurricane protection project is not recommended. Damages from future hurricanes could be reduced by raising roads and adopting zoning regulations. It is recommended that the report be published and distributed to appropriate local interests to serve as a guide in development of flood plain regulation, zoning ordinances, building codes, evacuation plans and other safety measures.

TABLE OF CONTENTS

TABLE OF CONTENTS
(Cont'd)

PLATES

APPENDIX

U. S. ARMY ENGINEER DISTRICT, WASHINGTON
CORPS OF ENGINEERS
FIRST AND DOUGLAS STREETS, N.W.
WASHINGTON 25, D. C.

SUBJECT: Hurricane Survey - Colonial Beach, Virginia

TO: Division Engineer
U. S. Army Engineer Division, North Atlantic
New York, New York

PURPOSE

1. The purpose of this report is to present the findings of an extended reconnaissance survey of the hurricane problem at Colonial Beach, Virginia, and to present recommendations for reduction of damages during future hurricanes.

AUTHORITY

2. This report is submitted in compliance with authorization contained in Public Law 71, 84th Congress, 1st Session, approved 15 June 1955, which reads:

> Sec. 1. "Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled. That in view of the severe damage to the coastal and tidal areas of the eastern and southern United States from the occurrence of hurricanes, particularly the hurricanes of August 31, 1954, and September 11, 1954, in the New England, New York, and New Jersey coastal and tidal areas, and the hurricane of October 15, 1954, in the coastal and tidal areas extending south to South Carolina, and in view of the damages caused by other hurricanes in the past, the Secretary of the Army, in cooperation with the Secretary of Commerce and other Federal agencies concerned with hurricanes, is hereby authorized and directed to cause an examination and survey to be made of the eastern and southern seaboard of the United States with respect to hurricanes, with particular reference to areas where severe damages have occurred.
>
> Sec. 2. Such survey, to be made under the direction of the Chief of Engineers, shall include the securing of data on the behavior and frequency of hurricanes, and the determination of methods of forecasting their paths and

improving warning services, and of possible means of preventing loss of human lives and damages to property, with due consideration of the economics of proposed breakwaters, seawalls, dikes, dams, and other structures, warning services, or other measures which might be required."

The survey of Colonial Beach, Virginia, was approved by the Chief of Engineers, 5 December 1956, by letter EMCWD, subject "Hurricane Appraisal Report" to the North Atlantic Division.

SCOPE

3. This report of extended reconnaissance scope presents the results of studies of hurricane tidal flooding and wave damage to the Town of Colonial Beach, Virginia, and adjacent areas. Field surveys were made to determine elevations of pertinent topographic and interior drainage features and to establish reference elevations for damage surveys. A detailed damage survey was made to establish stage-damage curves for tidal flooding and wave action. Office studies included compilation of hurricane data, analysis of tide and wind records from the nearby U. S. Naval Weapons Laboratory at Dahlgren, Virginia, and other applicable records, determination of tidal flooding frequency and computation of probable wave heights. Protective plans were examined in sufficient detail to consider economic feasibility.

PRIOR REPORTS

4. There are no prior reports which deal specifically with the hurricane problem in the Colonial Beach area. The following reports were made on navigation and beach erosion problems in the area.

a. A preliminary examination and survey of Monroe Bay and Creek was authorized by Section 8 of the River and Harbor Act approved March 3, 1925. Monroe Creek and the Potomac River bound the peninsula on which the town of Colonial Beach is located. The preliminary examination report dated August 14, 1926, and the survey report dated November 19, 1927, are published in House Document No. 172, 70th Congress, 1st Session. A plan of improvement was recommended which provided for a channel 8 feet deep and 100 feet wide at the entrance and a channel within the creek 7 feet deep and 100 feet wide to a turning and anchorage basin 500 feet wide on the downstream side of Robins Grove Point. The project was adopted by the River and Harbor Act approved July 3, 1930, and was completed in 1931.

b. A review of reports on Monroe Bay and Creek was authorized by a resolution of the Committee on Rivers and Harbors of the House of Representatives, dated April 28, 1936. The review report, dated November 16, 1936, was transmitted to Congress April 8, 1937, but was not published. The recommendation was unfavorable to modification of the existing project.

c. A second review of reports on Monroe Bay and Creek was made in response to a resolution by the U. S. Senate Committee on Public Works, adopted 22 July 1947. The review report dated 15 April 1955, was transmitted to Congress 17 June 1955 with the recommendation that the project not be modified.

d. A Beach Erosion Control Study for Colonial Beach, Virginia, was made under the provisions of Section 2 of the River and Harbor Act approved 3 July 1930 (Public Law No. 520, 71st Congress) and an act approved 31 July 1945 (Public Law No. 166, 79th Congress). Federal participation in the construction was recommended under the provisions of Public Law No. 166, 79th Congress, approved 13 August 1946. The report was published as House Document No. 333, 81st Congress, 1st Session. The project was authorized by the River and Harbor Act of 1950 (Public Law 516, 81st Congress, 2nd Session).

DESCRIPTION

5. Location. Colonial Beach is located on the west side of the Potomac River, 69 miles downstream from Washington, D. C., and 40 miles upstream from its mouth at Chesapeake Bay. The town occupies a low peninsula between the Potomac River and Monroe Creek, extending for about 1.6 miles above Gum Bar Point at the downstream end of the peninsula. The Potomac River is approximately 4 miles wide opposite Colonial Beach and the waterfront is exposed to a 25 mile fetch to the southeast.

6. Geology. The Colonial Beach area is situated on the Talbot terrace, one of the youngest members of the Pleistocene Period on the Coastal Plain. The materials of the area consist of sand, gravel, clay, peat and clay loam derived in part from wave action on the older coastal plain formations and in part from streams flowing from the Piedmont Plateau and the Appalachian regions to the west of the Coastal Plain. Recent deposits in the form of beaches, bars, sand pits and dunes border the Talbot deposits on the water side. The beaches are generally gravelly ranging from 10 to 70 percent of fine sand and are nourished mainly by erosion of adjacent surface features as terraces and bars.

7. Topography. The peninsula occupied by part of the town has a range of elevations from 6.0 to 14.0 feet above mean low water. The beach in this region graduates from an eroded bank to a gentle slope which includes a narrow strip of beach. The section of the town upstream of the peninsula is characterized by higher elevations ranging from 10.0 to 24.0 feet above mean low water, with a waterfront consisting of high eroded banks and narrow beaches.

8. Tides. The mean range of the tide in the Potomac River at Colonial Beach as determined by the U. S. Coast and Geodetic Survey is 1.6 feet, with a spring range of 1.8 feet. Prolonged easterly or southeasterly winds tend to raise the water level in the river while prolonged northwest winds tend to depress the water level. Moderate storm tides raise the water 2 to 3 feet above mean high water.

9. Economic Development. Colonial Beach is primarily a waterfront resort town with the economy based on servicing the recreation trade. The permanent population is about 1,500 and the normal summer population is 5,000. This is further increased by the influx of weekend visitors. Colonial Beach is the principal population center of Westmoreland County and is readily accessible by highways from Baltimore, Richmond and Washington. The nearest available railroad facilities are at Fredericksburg, Virginia, 35 miles to the west. The town serves as a base for a small commercial seafood fleet which handles an average of 3,500 tons annually. There is a commercial seafood packing plant located on Monroe Creek. The harbor also has accommodations for recreational boating both for transient and permanent berthing. There are repair, fueling and icing facilities available for recreational boats and the commercial seafood fleet.

CLIMATOLOGY

10. The climate at Colonial Beach is temperate with moderate seasonal changes, long, warm summers and generally mild winters. The average temperature is 57 degrees Fahrenheit, with extremes of approximately 100 degrees and 5 degrees. The warmest month is July with an average daily temperature being 80 degrees. The coldest month is December with an average daily temperature of 35 degrees. The annual precipitation is about 37 inches, fairly well distributed throughout the year. Snow occurs generally in light amounts and usually melts in a short period of time. The average annual snowfall is 10 inches, occurring in December through March. Predominant winds in the area are from the northwest, southwest and southeast. Prevailing winds during 8 months of the year are from the northwest, September to April, from the southeast in May and August and from the southwest during June and July. Winds with velocities exceeding 24 miles per hour are predominantly from the northwest.

HURRICANES AND OTHER TROPICAL STORMS

11. Numerous storms of tropical origin have passed over and near the lower reaches of the Potomac River causing widespread damage. Although the hurricanes are very destructive, the winds are generally reduced below hurricane velocity as they pass through the area. There are no official records of sustained velocities of 75 miles per hour or greater. However, hurricanes occurring before records were kept, such as the great Chesapeake Bay storms of 1667, 1749 and 1788, may have produced hurricane velocity winds. The hurricane of 23 August 1933 was the most destructive of modern times for this area as well as the remainder of the Chesapeake Bay Region. The track of this storm, as shown on Plate 4, passed about 6 miles east of Colonial Beach. The storm tide from this hurricane coincided with the astronomical high tide and caused a total rise of 8.0 feet above mean low water. A local newspaper published the day after the storm estimated the damage from high tide, waves and wind to exceed $150,000. On the basis of present day prices this would be over $500,000. Hurricane "Hazel", 15 October 1954, caused damages to Colonial Beach estimated by local officials to be about $500,000. The

storm track as shown on Plate 4 passed about 40 miles to the west of Colonial Beach, causing sustained winds from the southeast. These winds passing over the 25 mile fetch caused tides 6.2 feet above mean low water and 6-foot waves. During 1955 two hurricanes affected the Colonial Beach area. "Connie", 12-13 August, passed approximately 30 miles to the east causing only minor damage since the storm surge occurred at the time of astronomical low tide. "Diane", 17-18 August, passed inland 50 miles to the west and did not produce a damaging tide.

STORM TIDE FREQUENCY

12. The determination of storm tide frequency for the area was hampered by inadequate tide records. The only official tide records for Colonial Beach, compiled by the U. S. Coast and Geodetic Survey for the period 1903 to 1910, disclose no unusually high tides. The peak tide elevations for the 1933 and 1945 hurricanes were established by field surveys immediately after the storms. Hourly tide readings have been recorded at the U. S. Naval Weapons Laboratory at Dahlgren, Virginia, 6 miles to the north of Colonial Beach, since 1953. These records encompass the 1954 and 1955 hurricanes and are applicable to Colonial Beach. The Colonial Beach and Dahlgren records were correlated with the Washington, D. C., continuous records for 1931-1957 and intermittent records of unusual tidal events from 1858 to 1931. The frequency curve, developed from these data by the procedures given in "Statistical Methods in Hydrology" by L. R. Beard, is shown on Plate 4. The high tide of record of 8.0 feet which occurred on August 1933 appears to have about a 1.3 percent chance of annual occurrence.

STANDARD PROJECT HURRICANE AND RESULTING TIDES

13. The standard project hurricane for the Chesapeake Bay area has been selected as the Cape Hatteras Hurricane of September 1944 transposed to a critical path over the Chesapeake Bay. The probable storm surge in the Potomac River in the vicinity of Colonial Beach from such a hurricane is estimated to be about 10.6 feet, ± 0.5 foot, from data shown by Bretschneider in the Beach Erosion Board Miscellaneous Paper No. 3-59, "Hurricane Surge Predictions for Chesapeake Bay". The height of such a tide surge would range from about 13.0 above mean low water for the upper limit occurring at the time of an astronomical high tide, to about 10 feet for the lower limit occurring at the time of an astronomical low tide.

HURRICANE DAMAGES

14. A damage survey was made during August 1956 using the first floor elevations established by field survey for reference. Tidal flood damages were assessed for elevations 6.2, 7.0, 10.0 and 12.0 feet above mean low water in areas where damages could be prevented by construction of local protection works. The damage estimates include the development

along Monroe Creek that could be protected by a barrier or local protection works, but does not include damages to the amusement piers extending into the Potomac River, or to the beaches and banks outside of the considered protection works.

15. The topography permitted separation of Colonial Beach into two sectors for assessing damages and considering protective works. Area "A", south, or downstream of Boundary Street includes summer and permanent residences, a few small business establishments and the marina and commercial facilities fronting on Monroe Creek. Area "B", north of Boundary Street, includes residences, business establishments, amusement facilities and municipal property.

16. Damages due to wave action were computed for structures fronting along the Potomac River only, and were estimated to be 50 percent of the tidal damages that would be sustained at each reference elevation for each structure. Damages for tide and wave action that could be expected for recurrences of the August 1933 and October 1954 hurricanes are estimated to be $378,000 and $270,000 respectively. Stage-damage curves are shown on Plate 4.

EXISTING CORPS OF ENGINEERS PROJECTS

17. The only completed Corps of Engineers project in the area is the Monroe Bay and Creek navigation project providing a 7-foot deep, 100-foot wide channel and a turning basin. The shore protection project for Colonial Beach, Virginia, authorized by the River and Harbor Act of 1950 (Public Law 516, 81st Congress, 2nd Session) in accordance with plans included in House Document numbered 333, 81st Congress, 1st Session, provided for the construction of 7,350 lineal feet of stone revetment for the protection of a public highway and adjacent properties. The plan called for the initial construction of 3,600 linear feet of revetment and 3,750 lineal feet for deferred construction about 10 years later. The project area as shown on Plate 2 extends along the riverside of Irving Avenue from Boundary Street southward to Monroe Bay Avenue. No work has been accomplished on this project and it is now considered inactive.

IMPROVEMENTS BY OTHERS

18. The only water development project by others related to the hurricane problem is a program of bank slope paving by the Virginia Department of Highways to protect Irving Avenue which lies along the Potomac River waterfront. This work as shown on Plate 2, is in the same area as the authorized shore protection project described in paragraph 17. The work completed as of December 1960 includes 840 lineal feet of sand asphalt slope paving and about 2,100 lineal feet of concrete slope paving.

19. The Virginia Department of Highways has requested the Corps of Engineers to consider acceptance of this work in partial compliance of the local participation requirements of the beach erosion project. However,

the work in place is not considered an acceptable substitute for the rock revetment protection of the authorized project because of structural deficiencies. Modifications have been suggested to the Virginia Department of Highways by the District Engineer but no further action has been taken.

IMPROVEMENTS DESIRED

20. A public hearing was held in Colonial Beach on 8 February 1956. Protection was requested to prevent tide and wave damage to waterfront structures, roads and beaches and for protection of the harbor facilities in Monroe Creek.

HURRICANE PROBLEMS AND SOLUTIONS CONSIDERED

21. Part of the town of Colonial Beach occupies an exposed position on a peninsula lying parallel to the Potomac River, and is subject to storm damages including tidal flooding of houses, commercial establishments, streets, yards and marina facilities. About 15 residences and 20 business buildings have first floor elevations below the 8.0 foot tide of record. In addition, buildings and other structures along the waterfront are subject to wave damages. Wind damage has also been severe but is not preventable. Damage to Irving Avenue along the Potomac River waterfront is a major concern to the town and to the Virginia Department of Highways. The town and various segments are not in danger of isolation except in the case of tides that might be caused by a hurricane of the standard project magnitude.

22. The structural solutions considered include levees, concrete walls and a barrier with a navigation gate across the mouth of Monroe Creek. Also considered were warning and evacuation plans and zoning proposals.

HURRICANE PROTECTION PLANS CONSIDERED

23. General. Protective works were considered for those sections of Colonial Beach subject to tidal flood damages. The design tide elevation for the plans described in this report is 8 feet above mean low water with the top of protective works set at 10 feet. This would provide protection against a tide equal to that caused by the August 1933 hurricane. Plans for lower elevation would not meet the criteria for hurricane protection. Plans for protection against hurricane tides greater than the maximum of record reflected lower benefit cost ratios because of low probability of occurrence that must be assigned to such tides. All of the plans were based on the premise that the beach protection project as authorized, or its equivalent, would be in place. Since the damage areas were separable with Boundary Street as the approximate dividing line, protective plans were investigated for the areas

singly and in combination. Plan 1 is considered to most nearly meet the requirements for hurricane protection for Colonial Beach. Plans 2, 3 and 4 are alternates investigated in an effort to find an economical means of reducing hurricane damages.

24. Plan 1. Plan 1, as shown on Plate 3, would provide protection from tidal flooding of areas "A" and "B" and would reduce storm tide elevations in Monroe Creek. The protective works for area "A" consists of approximately 4,320 linear feet of concrete I wall placed riverside of Irving Avenue; one segment about 3,000 feet long, located from a point 270 feet north of Lafayette Street to the intersection of Chamberlayne Street and the second segment of about 1,320 feet from a point 170 feet north of Dandridge Avenue to the intersection of Irving Avenue and Monroe Bay Avenue. From this intersection southward would be 1,600 feet of earth levee with riprapped slope protection. A 400 foot rock dam would be required across the mouth of Monroe Creek. Sector gates would provide a 30 foot opening for the existing navigation channel. The remaining protective works would be 900 feet of riprapped earth levee extending to the 10 foot contour on Sebastian Point. In addition to protecting the land area within Colonial Beach from tidal flooding, this plan would provide a safe harbor of refuge in Monroe Creek.

25. Protection for Area "B" under Plan 1 would be provided by a reinforced concrete wall approximately 3,300 feet in length extending from the intersection of Boundary Street and Irving Avenue, northward along Beach Terrace Drive and the boardwalk to Given Street. The top of the wall would be about 5 feet above the beach and boardwalk. Although the wall would prevent tidal flooding, it would obstruct the view and restrict the utility of this reach.

26. Plan 2. Plan 2, as shown on Plate 3 would incorporate the same protective works for area "B" as described under Plan 1. The protective works for area "A" under this plan is identical to Plan 1 from Boundary Street south to the end of the I-wall at the intersection of Irving Avenue and Monroe Bay Avenue. From this point the sections of Monroe Bay Avenue below 8 feet mean low water would be raised to that elevation to serve as a levee. This plan would not protect the area between Monroe Bay Avenue and Monroe Creek and would not exclude the high tides from the Monroe Creek harbor.

27. Plan 3. Plan 3 is the same as Plan 2 except the protection for area "B" is eliminated.

28. Plan 4. Plan 4 consists of 3,000 feet of concrete I-wall along the riverside of Irving Avenue from a point 270 feet north of Lafayette Street to Chamberlayne Street.

29. Other Protective Measures. Since protective structures for flood damage reduction cannot be justified for the Colonial Beach area, mitigation of damages by other means should be considered by the local government. Partial protection could be gained by completion of the authorized beach protection project or its equivalent, and by raising

the access roads leading to the Monroe Creek marina facilities. Other measures would be the formulation of zoning ordinances and building codes to regulate future development in the area susceptible to tidal flooding. Evacuation Planning was considered, however, the short distances involved in reaching a safe elevation and the elevations of interior roads on the peninsula were the basis for not formulating an evacuation plan for the area. The Town of Colonial Beach is included on the list of communities to be warned in the event of extreme tides by the U. S. Weather Bureau, Washington, D. C.

ESTIMATES OF FIRST COSTS AND ANNUAL CHARGES

30. The first costs and annual charges of the protective plans previously described are contained in Table 1. Construction costs are based on July 1960 price level and the estimated costs of the principal features includes an appropriate contingency allowance. Federal annual charges are based on 70 percent of the estimated construction cost plus the pre-authorization study cost. Non-Federal annual charges include 30 percent of the estimated construction cost and estimated cost of annual operation and maintenance.

TABLE 1

Estimates of First Costs and Annual Charges
(July 1960 Price Level)

Principal Features	Plan 1	Plan 2	Plan 3	Plan 4
	$	$	$	$
Lands and Damages	13,000	11,500	6,000	1,200
Levees and Floodwalls	359,000	281,500	38,700	29,800
Tidal Control Structure	272,000	-	-	-
Road Revisions	-	29,500	29,500	-
Engineering and Design	58,000	29,000	10,000	3,000
Supervision and Administration	38,000	19,500	6,800	2,000
Total Estimated Construction Cost	740,000	371,000	91,000	36,000
Pre-Authorization Studies	25,000	20,000	15,000	5,000
TOTAL ESTIMATED FIRST COSTS	765,000	391,000	106,000	41,000
Distributed Costs:				
Federal: 70% of Est. Constr. Cost	518,000	260,000	64,000	25,200
Pre-Authorization Studies	25,000	20,000	15,000	5,000
TOTAL (Federal)	543,000	280,000	79,000	30,200
Non-Fed: 30% of Est. Constr. Cost	222,000	111,000	27,000	10,000
Estimated Annual Charges:				
Federal: Interest @ 2.625%	14,300	7,400	2,100	800
Amort. @ 2.625% @ 50 yrs.	5,400	2,800	800	300
TOTAL (Federal)	19,700	10,200	2,900	1,100
Non-Fed: Interest @ 3.5%	7,800	3,900	900	400
Interest @ 3.5% @ 50 yrs.	1,700	800	200	100
Operation & Maintenance	4,200	1,900	800	300
TOTAL (Non-Fed)	13,700	6,600	1,900	800
TOTAL ESTIMATED ANNUAL CHARGES	33,400	16,800	4,800	1,900

ESTIMATES OF BENEFITS

31. The benefits were computed on the basis of reduction of damages from tidal flooding and wave action to residential and commercial properties, utilities and streets for all plans considered. In addition, Plan 1 would reduce damages to marina facilities and boats in Monroe Creek. No benefits are assigned for the protection of Irving Avenue roadway since these benefits were previously claimed for the authorized Beach Protection Project. The average annual benefits for the 4 plans are as follows: Plan 1, $14,000; Plan 2, $5,000; Plan 3, $1,900; and Plan 4, $1,100.

COMPARISON OF BENEFITS AND COSTS

32. Each of the plans investigated were found to have an unfavorable benefit-cost ratio as shown in the following tabulation:

Plan	Annual Benefits	Annual Charges	Benefit/Cost Ratio
1	$ 14,000	$33,400	.4
2	5,000	16,800	.3
3	1,900	4,800	.4
4	1,100	1,900	.6

PROPOSED LOCAL COOPERATION

33. The local cooperation would be based on the cost sharing formula adopted by the Flood Control Act of 1958, Public Law 85-500, 85th Congress, for the Narragansett, New Bedford and Texas City projects where local interests were required to pay at least 30 percent of the first costs of construction. Included in the 30 percent would be the costs of lands, easements and rights-of-way, highway revision and utility changes. The operation and maintenance would also be a local responsibility.

ALLOCATION OF COSTS AMONG PURPOSES

34. All plans considered are single purpose hurricane protection projects not requiring allocation of costs among purposes.

APPORTIONMENT OF COSTS AMONG INTERESTS

35. The apportionment of costs among interests based on the cost sharing formula as stated in paragraph 33, and the estimated annual operation and maintenance cost to local interests for the four plans are as follows:

Plan	Federal First Cost	Non-Federal First Cost	Non-Federal Annual Operation & Maintenance
1	$ 543,000	$ 222,000	$ 4,200
2	280,000	111,000	1,900
3	79,000	27,000	800
4	30,200	10,800	300

COORDINATION WITH OTHER AGENCIES

36. The United States Fish and Wildlife Service has been informed of the protective plans considered and has made no adverse comments. However, in case of future recommendations for the construction of a barrier the Fish and Wildlife Service would study and comment on the effect of the plan on fish and wildlife interests existing at that time. Close coordination was maintained with the Town of Colonial Beach during the damage survey and project formulation stages. Comments of the Fish and Wildlife Service and the Town of Colonial Beach are included in Appendix A.

DISCUSSION

37. The Town of Colonial Beach, Virginia, because of its exposed location, has suffered considerable damages from hurricanes. Although wind velocities are generally reduced below the hurricane force of 75 miles per hour, the combined effects of high tides, waves and winds are very destructive. The tide and wave damages in the area could be eliminated or reduced by structural measures. However, the construction of protective works to withstand hurricane force is costly and tends to reduce the utility of waterfront properties by occupying valuable space and obstructing the view and access to the beaches. The lowest tide considered for design of hurricane protection of Colonial Beach was 8 feet above mean low water. This is the maximum observed tide of record for the area. For the 8-foot design tide each of 4 plans of protection considered were found to be not economically justified. In addition, the benefit cost ratios were found to be progressively smaller for higher design tides including the tide which would be generated by the Standard Project Hurricane for the region.

CONCLUSIONS

38. Colonial Beach, Virginia, is subject to severe damages by tidal flooding, wave action and winds from hurricanes and northeast storms. The damages could be reduced by the protective works, but the construction could not be economically justified on the basis of average annual benefits. Damages to the town could be reduced by (a) completion of the authorized beach protection project or its equivalent (b) raising of access roads leading to the Monroe Creek marina facilities (c) adoption of local zoning regulations with respect to elevation and exposure.

RECOMMENDATIONS

39. It is recommended that hurricane protection works for Colonial Beach, Virginia, not be authorized at this time. It is recommended that the report be published for distribution to local interests for their use as a basis for possible formulation of future zoning and building regulations.

J. U. ALLEN
Colonel, Corps of Engineers
District Engineer

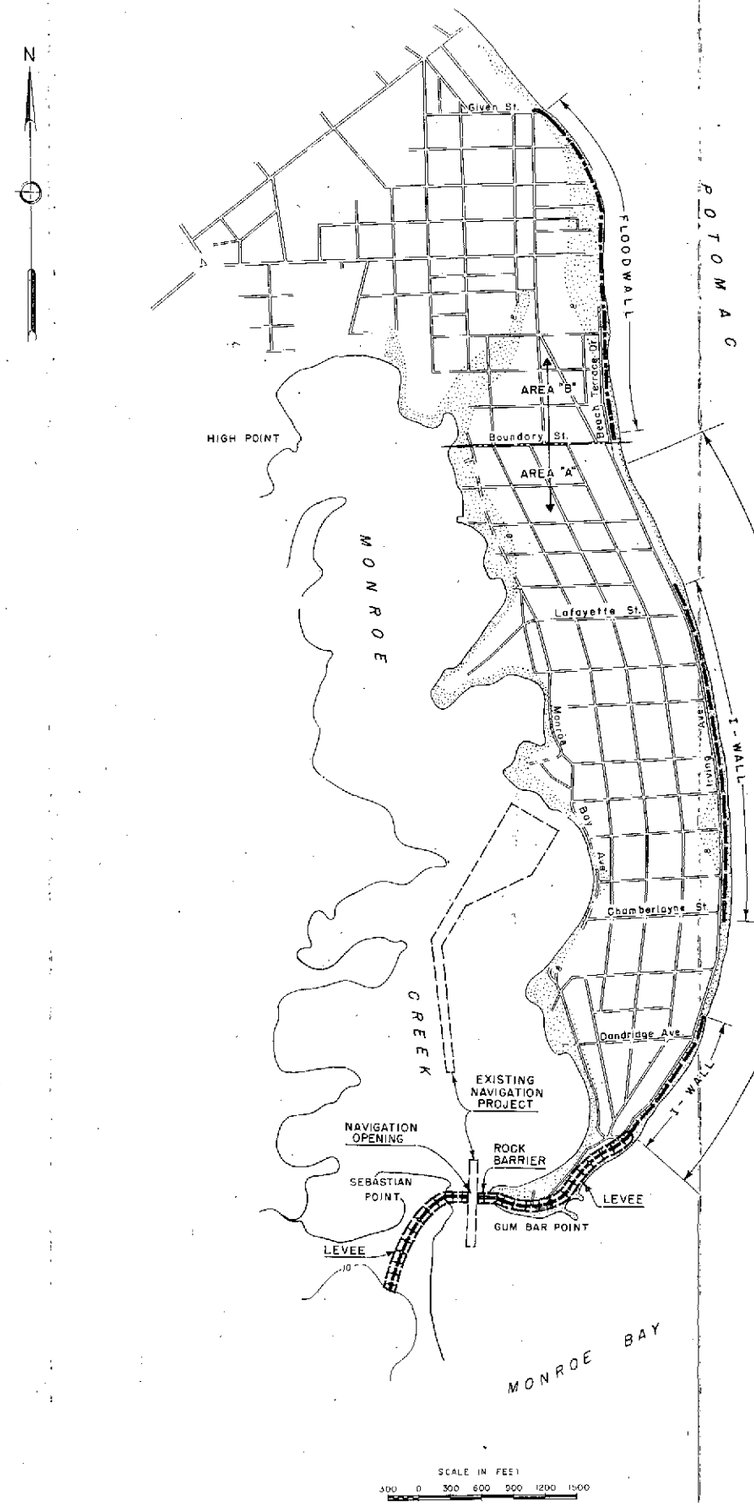
NADEN-R (28 Feb 61) 1st Ind
SUBJECT: Hurricane Survey, Colonial Beach, Westmoreland County, Virginia

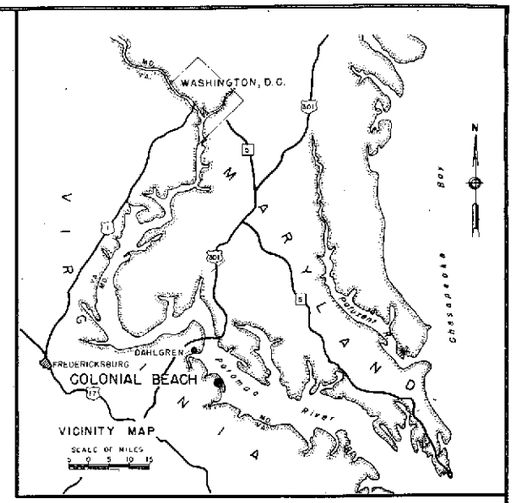
U. S. Army Engineer Division, North Atlantic, New York, New York
28 April 1961

TO: Chief of Engineers, Department of the Army, Washington, D. C.
ATTN: ENGCW-P

I concur in the conclusions and recommendations of the District Engineer.

T. H. LIPSCOMB
Brigadier General, USA
Division Engineer





PLAN OF IMPROVEMENT

Area "A"

400 ft. barrier with gated navigation opening at mouth of Monroe Creek, 1600 ft. of earth levee with rip-rapped slope protection and 4320 ft. of concrete I-wall along Irving Avenue.

Area "B"

3300 ft. of reinforced concrete floodwall between Boundary and Given Streets.

NOT RECOMMENDED

Area inundated by August 1933 Hurricane

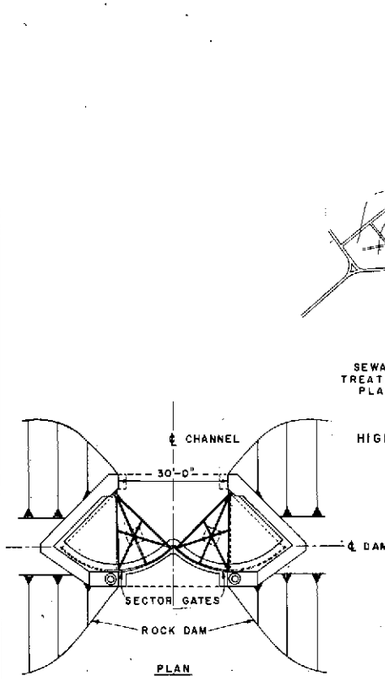
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

DRAWN BY: G.B.P.
TRACED BY: M.M.K.
CHECKED BY: J.B.C.
REVIEWED FOR SAFETY BRANCH
Safety Engineer
PREPARED BY: F.B. Mora
CHIEF, PLANNING & REPORTS SECT.
SUBMITTED BY:
CHIEF, HYDRAULIC BRANCH
APPROVED:
Col. Corps of Engineers, District Engineer

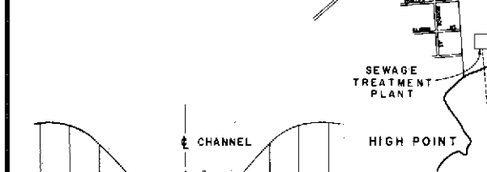
HURRICANE SURVEY
COLONIAL BEACH, VA.

GENERAL PLAN

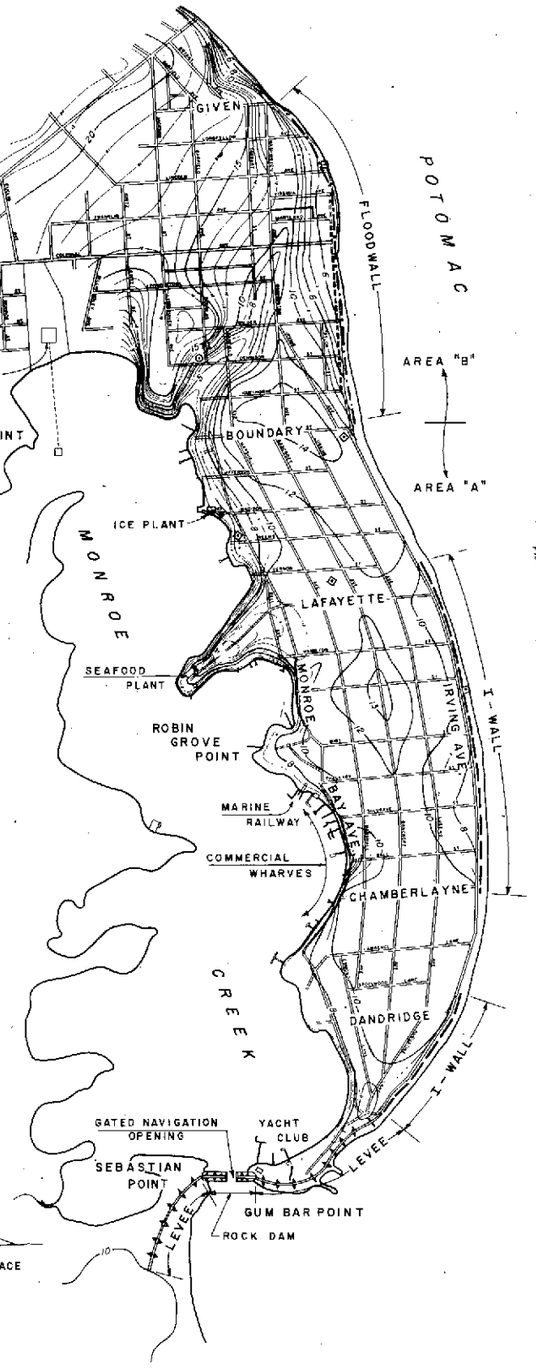
RECOMMENDED: R.A. Hayes, Chief, Engineering Division
DATE: MAR. 1961
SCALE: AS SHOWN
SPEC. NO.
DRAWING NO: B-230-19.1
SHEET 1 OF 4



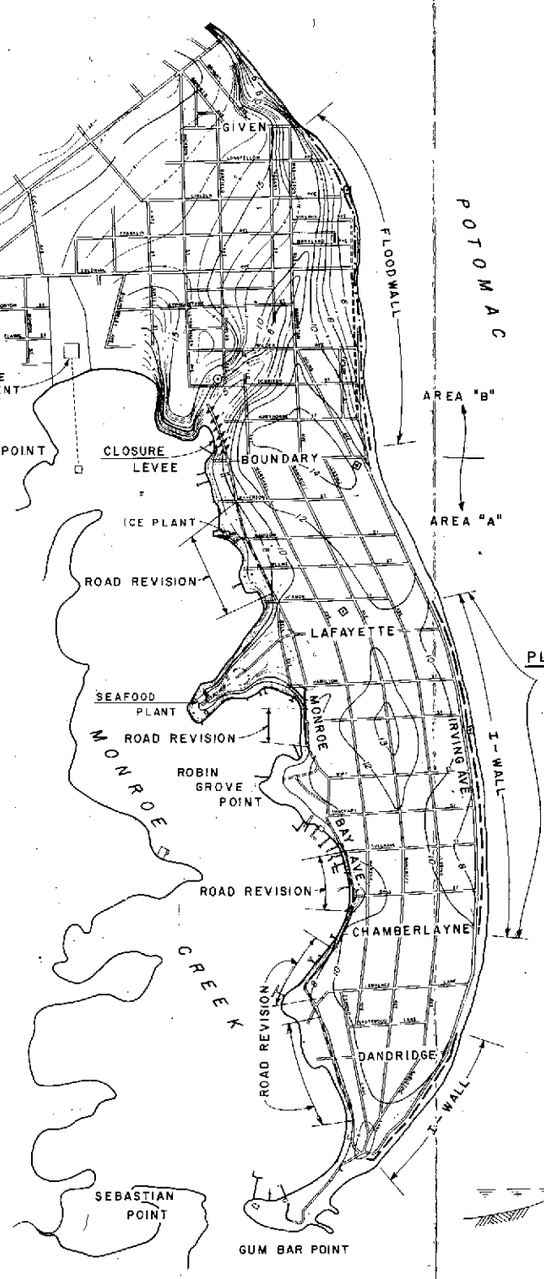
MONROE CREEK-NAVIGATION GATES



TYPICAL LEVEE SECTION



PLAN 1



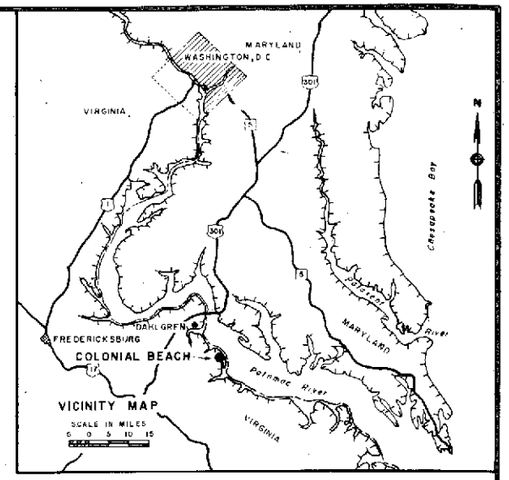
PLANS 2, 3 & 4

LEGEND

- CONCRETE I-WALL
- CONCRETE FLOODWALL
- ROCK DAM
- LEVEE
- PUMPING STATION
- NAVAL RANGE STATION
- ELEVATED WATER TANK
- ROAD REVISION

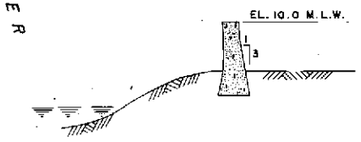
SCALE IN FEET

800 0 300 600 900

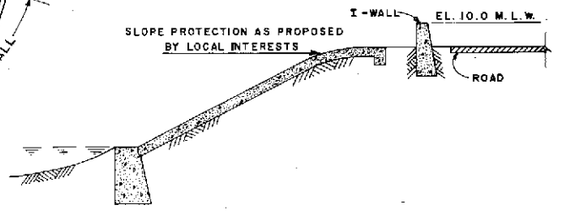


PLAN 4

CONSISTS OF I-WALL BETWEEN THESE LIMITS



TYPICAL SECTION OF FLOODWALL "AREA B"



TYPICAL SECTION OF I-WALL "AREA A"

NOTES:

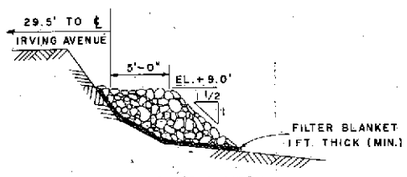
PLAN 2 — INCLUDES ALL PROTECTIVE WORKS SHOWN
PLAN 3 — SAME AS PLAN 2 EXCEPT FLOODWALL FOR AREA "B" DELETED
PLAN 4 — I-WALL ONLY FROM LAFAYETTE STREET TO CHAMBERLAYNE STREET

DRAWN BY: D.B.P.
TRACED BY: D.B.P.
CHECKED BY: J.B.C.
REVIEWED FOR SAFETY BRANCH
PREPARED BY: F.B. Morris, CHIEF, PLANNING & PROJECTS SECT.
SUBMITTED BY: R.H. Wadsworth, CHIEF, CIVIL WORKS BRANCH
APPROVED: Colonel, Corps of Engineers, District Engineer

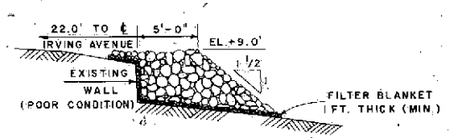
HURRICANE SURVEY
COLONIAL BEACH, VA.
PROTECTIVE PLANS CONSIDERED BUT NOT RECOMMENDED

RECOMMENDED: R.H. Hayes, Chief, Engineering Division
DATE: DEC. 1960
SCALE: AS SHOWN
SPEC. NO.
DRAWING NO: 8-230-19.2
SHEET 2 OF 4

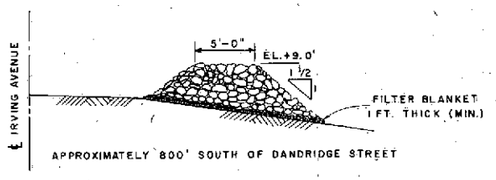
PLATE 2



VICINITY OF WEEMS STREET

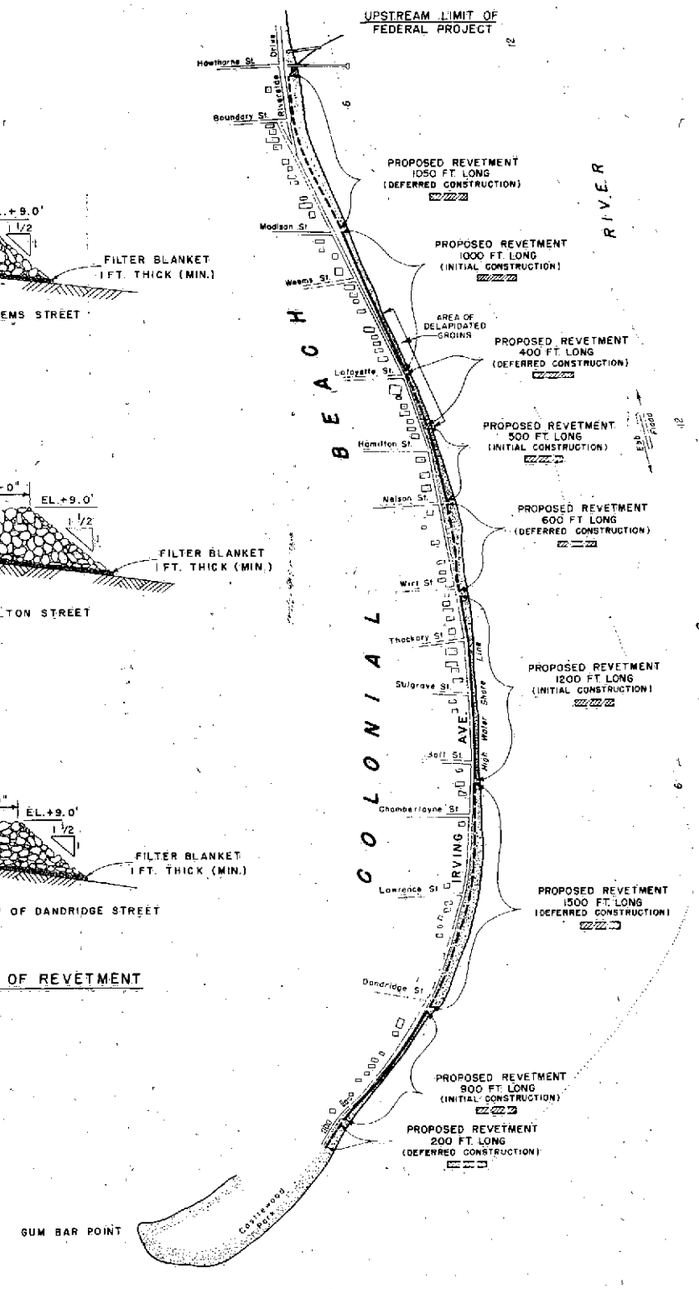


VICINITY OF HAMILTON STREET



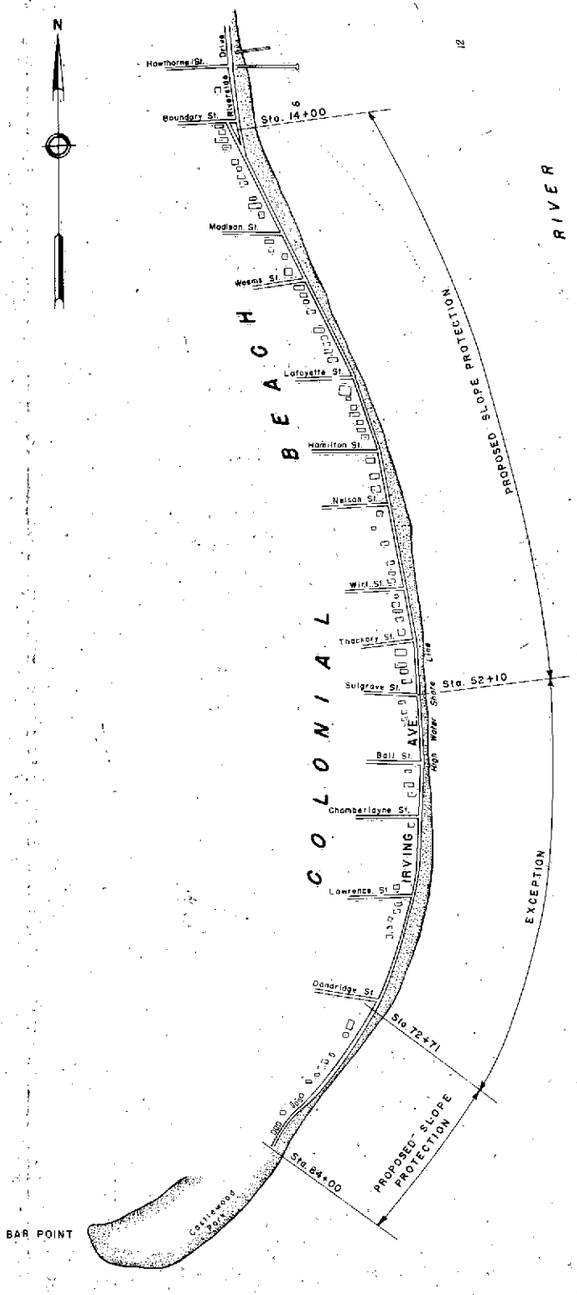
APPROXIMATELY 800' SOUTH OF DANDRIDGE STREET

TYPICAL SECTIONS OF REVETMENT



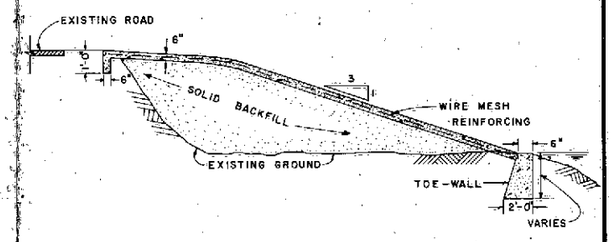
AUTHORIZED PLAN OF BEACH EROSION CONTROL

House Document No. 333, 81st Congress, 1st Session



PLAN OF BEACH EROSION CONTROL PROPOSED BY LOCAL INTERESTS

SCALE IN FEET
300 0 300 600 900



PROPOSED REINFORCED CONCRETE SLOPE PROTECTION

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

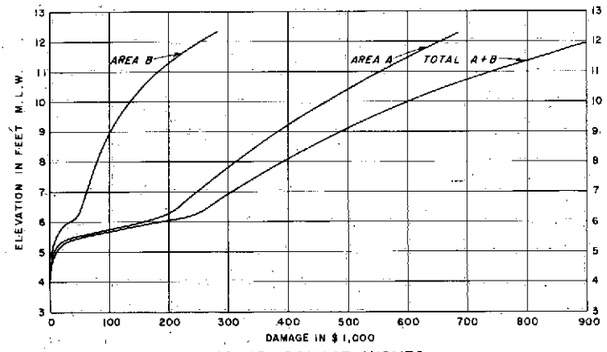
DRAWN BY: D.B.P.
TRACED BY: D.B.P.
CHECKED BY: J.B.C.
REVIEWED FOR SAFETY BRANCH
Safety Engineer
PREPARED BY
CHIEF PLANNING & REPORTS SECT.
SUBMITTED BY
CHIEF, CIVIL WORKS BRANCH
APPROVED
Lt. Colonel, Corps of Engineers, District Engineer

HURRICANE SURVEY
COLONIAL BEACH, VA.

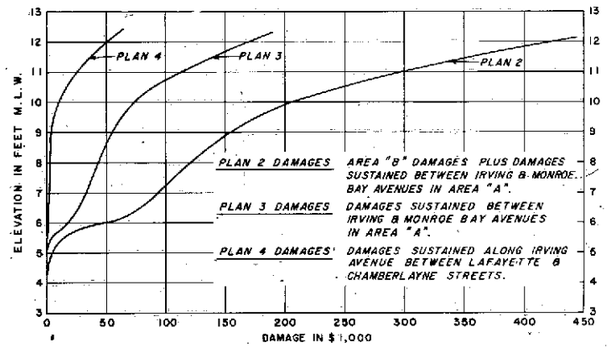
AUTHORIZED & PROPOSED PLANS OF BEACH EROSION CONTROL

RECOMMENDED
Chief, Engineering Division
DATE DEC. 1960
SCALE AS SHOWN
SPEC. NO.
DRAWING NO. 8-230-19.3
SHEET 3 OF 4

PLATE 3

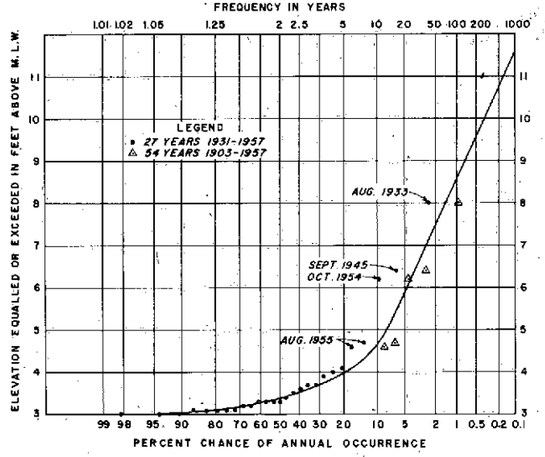


STAGE - DAMAGE CURVES
FOR
AREAS PROTECTED BY PLAN 1

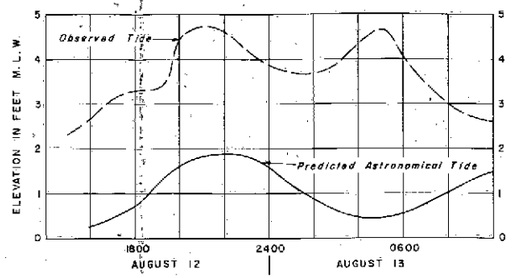


STAGE - DAMAGE CURVES
FOR
AREAS PROTECTED BY PLANS 2, 3 & 4

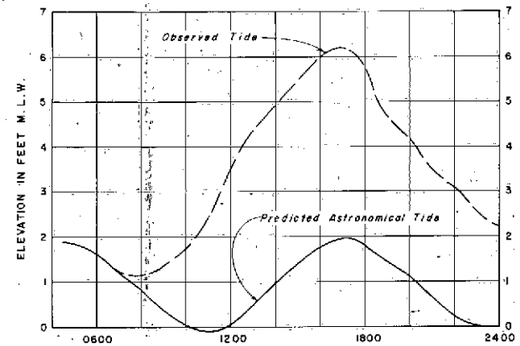
ECONOMIC DATA



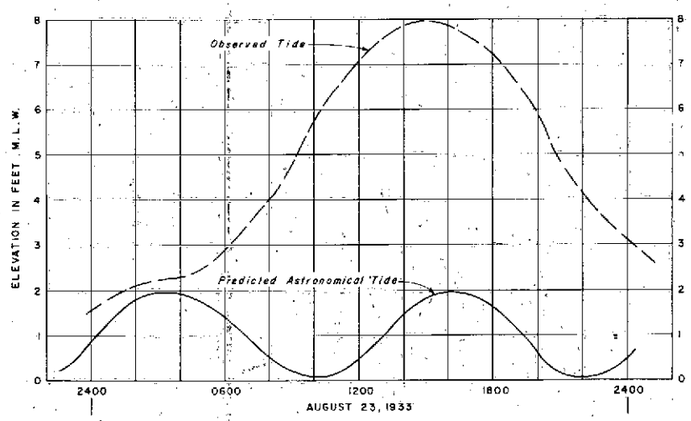
FREQUENCY OF TIDAL FLOODING



CONNIE
AUGUST 12 - 13, 1955

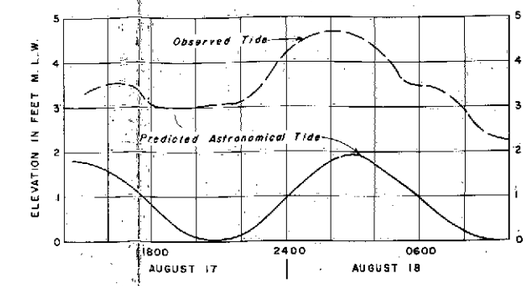


HAZEL
OCTOBER 15, 1954

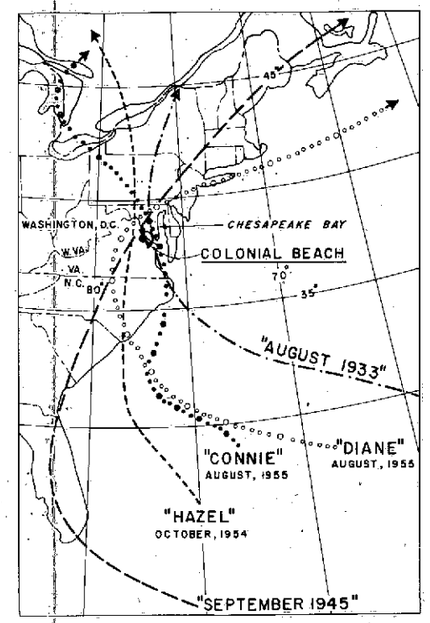


STORM OF RECORD
AUGUST 22 - 23, 1933

TIDE RECORDS



DIANE
AUGUST 17 - 18, 1955



TRACKS OF RECENT HURRICANES
AFFECTING COLONIAL BEACH

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
WASHINGTON DISTRICT, WASHINGTON 25, D. C.

DRAWN BY: D.B.P.
TRACED BY: D.B.P.
CHECKED BY: J.S.C.
REVIEWED FOR SAFETY BRANCH: Safety Engineer
PREPARED BY: Chief, Planning & Reports Sect.
SUBMITTED BY: Chief, Civil Works Branch
APPROVED: Col. Corps of Engineers, District Engineer

HURRICANE SURVEY
COLONIAL BEACH, VA.

ECONOMIC AND TIDAL FLOODING DATA

RECOMMENDED: Chief, Engineering Division
DATE: DEC. 1960
SCALE: AS SHOWN
SPEC. NO.
DRAWING NO.: B-230-19.4
SHEET 4 OF 4

APPENDIX A

PERTINENT CORRESPONDENCE

APPENDIX A

TOWN OF COLONIAL BEACH

COLONIAL BEACH, VIRGINIA

Playground of the Potomac

March 30, 1961

Colonel J. A. Allen,
District Engineer
U. S. Army Engineer District,
First and Douglas Streets N. W.,
Washington, D. C.

Dear Colonel Allen:

The plans for hurricane protection for Colonial Beach, dated December, 1960, have been reviewed.

We regret that the project was not considered favorable and sincerely hope that upon review this project will be economically justifiable at sometime in the future.

We sincerely appreciate the interest shown by you and your associates in making available your survey to the Town of Colonial Beach.

Very truly yours,

TOWN OF COLONIAL BEACH

Bernard F. Denson

Bernard F. Denson, Mayor

GF:b

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA 23, GEORGIA

ADDRESS ONLY THE
REGIONAL DIRECTOR

SOUTHEAST REGION
(REGION 4)
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
KENTUCKY
TENNESSEE
ALABAMA
MISSISSIPPI
ARKANSAS
LOUISIANA
VIRGINIA
MARYLAND
PUERTO RICO
VIRGIN ISLANDS

CE-MA-po (Z)

March 22, 1961

District Engineer
U. S. Army, Corps of Engineers
Washington, D. C.

Dear Sir:

We have reviewed the four plans of improvements to provide hurricane protection for the town of Colonial Beach, Westmoreland County, Virginia, which were furnished with Major Smith's letter of January 19, 1961. He advised that the plans as shown were not economically feasible and are not recommended for construction.

Based on our general knowledge of the area, the only feature of the considered plans that would have had a significant effect on fish and wildlife resources is the barrier restriction at the mouth of Monroe Creek. Since the plan was found economically infeasible, we will not undertake a study to determine the effects on fish and wildlife resources.

Thank you for the opportunity to comment on these plans.

Sincerely yours,

W. L. Towns
Acting Regional Director

HURRICANE SURVEY

COLONIAL BEACH
WESTMORELAND COUNTY, VIRGINIA

Additional information called for by Senate Resolution 148, 85th Congress, 1st Session, adopted 28 January 1958.

MARCH 1961

1. The information contained in this supplement is furnished in response to Senate Resolution 148, 85th Congress, 1st Session, adopted 28 January 1958. The resolution calls for data in addition to that contained in the basic report.

2. The protective plans considered but not recommended for construction, to reduce tidal flooding damages at Colonial Beach, Westmoreland County, Virginia, are presented in paragraphs 23 through 28 in the basic report and detailed on Plate 2 contained therein. The estimated cost of these protection plans, based on July 1960 prices, are shown in Table 1 of the report.

3. The benefit-cost ratios for the considered plans were calculated by using total tangible benefits and costs for an economic life of 50 and 100 years. Annual charges computed on this basis, exceed the annual benefits for all considered plans as follows:

50-Year Economic Life

Plan	Annual Benefits	Annual Charges	Benefit/Cost Ratio
1	$ 14,000	$ 33,500	.4
2	5,000	16,500	.3
3	1,900	4,400	.4
4	1,100	1,760	.6

100-Year Economic Life

1	14,000	27,900	.5
2	5,000	13,700	.4
3	1,900	3,700	.5
4	1,100	1,500	.7

4. The protective plans considered were designed to reduce damages from tidal flooding and wave action for occurrences up to and equivalent in magnitude to the August 1933 hurricane which flooded to an elevation of 8.0 feet mean low water at Colonial Beach.

5. The apportionment of costs as shown in the basic report was based on the cost sharing formula adopted by the Flood Control Act of 1958 for the Narragansett, New Bedford and Texas City projects. On the basis of this apportionment, had the major considered plans 1 and 2 been economically justified, costs assigned to local interests would have exceeded their financial capability.

6. Application of the standards as stated in Senate Resolution 148, do not provide a basis for departure from the report recommendations.